Issues on ITS and human factors interface

A/Prof Andry Rakotonirainy
r.andry@qut.edu.au

Imagine ….

you are in the US … you just created a revolutionary technology that has the potential to:

- **Sell millions of units worldwide**
- **Make their owner proud (and neighbours jealous)**
- **Hard to use (years of training)**
- **Move you from A to B effortlessly and swiftly**
- **Responsible for 33% of CO_2 fossil fuel emission**
- **kill 15 times more than 9/11 victims per year …**

Outline

- Rationale
- System approaches
- Research issues
  - Vehicle
  - Environment
  - Driver
- ICT Trends
- Future research

Rationale

- 1.2 million killed and 50 million injured each year worldwide (ECMT, 2006).
- Road traffic collisions cost an estimated US$ 518 billion globally in material, health and other expenditure (WHO 2007).

- Road crashes in Australia each year
  - costs $17 billion
  - 600,000 reported road crashes
  - 200,000 reported injuries
  - 22,000 serious injuries requiring long-term care and treatment
  - 1,700 people killed

Rationale (cont)

Road crashes:

- **Leading cause of unintentional injury-related death between the ages of 2 to 76**

- **By 2020, predicted to be the third largest cause of death and disability worldwide (WHO 2000, NSC 2006)**

ITS - fatal five

ITS could reduce fatalities and injuries by 40% across the OECD saving over USD 270 billion per year (WHO 2004)

Factors	Example of ITS based intervention	
	Active safety	Passive safety
Drink driving	Alcohol interlock	Airbag …
Speeding	Speed camera, ESP Intelligent Speed Adaptation	Airbag …
Fatigue	Eye blink detection Lane keeping, ESP …	Airbag …
Driver distraction	HMI design guidelines	Airbag …
Seat belt	Seat belt warning	pretension

Travel behaviour

- 1.2 hours a day commuting
  10% of total day time
- Many highways are
  "beyond" their capacity
  - 90% are still free space (throughput)
  - ☞ Why adaptive cruise control + lane keeping are not enough ?

Human cantered contextualised safety system

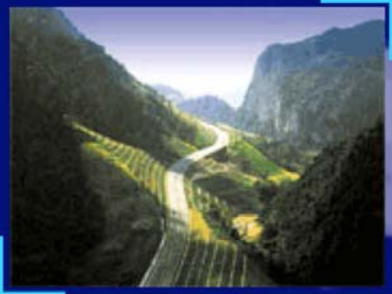
85% crashes - driver error
dysfunctioning system

Driver

Acquire,
evaluate
information

Control
Retro-action

Complex contextualized interactions



Environment

Vehicle

Mobility
of the vehicle

Human Factors and Environment

- Roads are not designed with safety as 1st priority
- Safe roads = self-explaining roads, drivers know how to behave based on road design (Theeuwes & Godthelp, 1992)

- E.g day& night views of approaching crest (HFG,2007)

☞Road design should be joint product of designers, traffic engineers and road users

Human Factors - Vehicle

Different level of driving assistance

- Detecting and understanding the environment
- Adapt interactions to drivers
  - Match (needs/capabilities , task demands)

A vehicle shouldn’t feel safer than what it is

- Constant feedback
- Emotional design

ICT everywhere

Technology everywhere

- 10^{10} processors sold in 2005
  - Only 2% were used in computers.
  - $121 bln worth of semiconductors sold in 1st half of 2007
- More software in a mobile phone than in Ariane 4 (1988).
- Most of current vehicles contains 50 communicating processors

Risks associated with in-vehicle ITS

- Driver distraction
- Driver overload
- Driver confusion
- False or nuisance alarms (reliable assessment)
- Behaviour adaptation
- Acceptability (useful, usable, affordable)

Design issues (1)

- **Human make mistakes, so do machines**

"As our technology becomes more powerful its failure at collaboration and communication becomes ever more critical. Collaboration means synchronizing one's activities as well as explaining and giving reasons. It means having trust, which can only be formed through experience and understanding. With automatic, so-called intelligent devices, trust is sometimes conferred undeservedly."

D. Norman 2007

Design issues (2)

“But as machines start to take over more and more they need to become socialized; they need to improve the way they communicate and interact and to recognize their limitations. Only then can they become truly useful.”

D. Norman 2007

Need for a better Human factor interface

Moving a vehicle in 2D requires

- **2 feet, 2 hands, eyes, head movements coordination**
- **2 years to have full driving licenses**
- **Interfaces have not radically changed 111 years**

First automobile on Pa. Avenue, 1896

Current & Future: CARRS-Q research

- System approach to :
  - Detect driver's impairments (distraction, vigilance, seniors)
  - Improve driver training (constant feedback, reporting)
  - Communicate drivers intentions and allow clearer collective decision-making (V2V, V2I)
- Emotional design (cannot separate emotion from cognition)
- Relationship between greenhouse emission and safety outcomes (smaller car, fuel consumption. Mopeds, pedestrian, seniors….)

Future of Human Factors design

- Last decades dominated by harmonizing interactions between
  - Mechanical controls
  - Digital devices
  - Analog drivers

- Next decades:
  - Return to physical devices where we control things by physical body movement (tactile, turning knob)
    - Back where machine age started !!!!